Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-2. (Canceled)

3. (Currently amended) The laminate as set forth in Claim [[2]] 5, wherein:

the acid dianhydride component includes the pyromellitic dianhydride in a range of from 5 mole% to 90 mole%.

4. (Currently amended) The laminate as set forth in Claim [[2]] 5, wherein:

the diamine component includes the paraphenylene diamine in a range of from 25 mole% to 75 mole%, and diaminodiphenyl ether in a range of from 25 mole% to 75 mole%.

5. (Currently amended) The A laminate as set forth in Claim 2 comprising a metal layer and a polyimide film, the metal layer being directly formed on the polyimide film having a dynamic viscoelasticity whose tan δ peak is located in a range of not less than 310°C but not more than 410°C, and whose tan δ value at 300°C is not more than 0.05, the polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component,

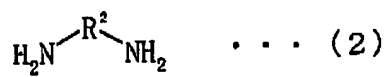the acid dianhydride component including a pyromellitic dianhydride represented by Equation (1):

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

... (1)
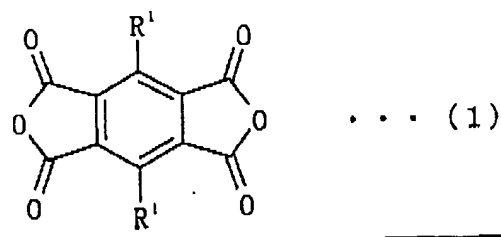
where R^1 is a residue selected from a group consisting of H-, CH_3-, CF_3-, Cl-, Br-, F-, and CH_3O-, and R^1 may be the same residues or different residues, and the diamine component including a paraphenylene diamine and a diaminodiphenyl ether,
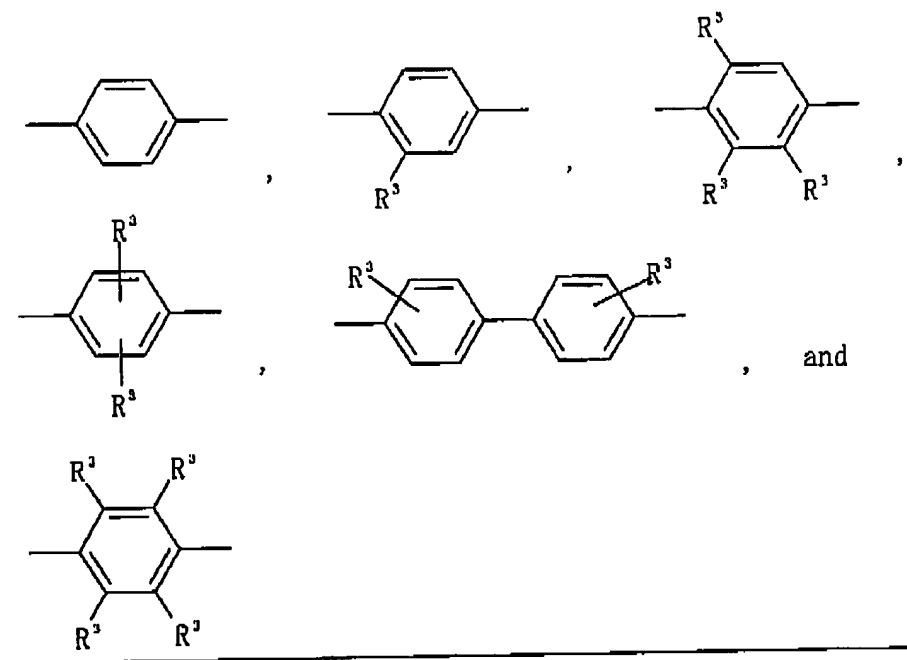
the paraphenylene diamine being represented by Equation (2):

... (2)

where R^2 is a bivalent aromatic group selected from a group consisting of:

Page 3 of 38

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
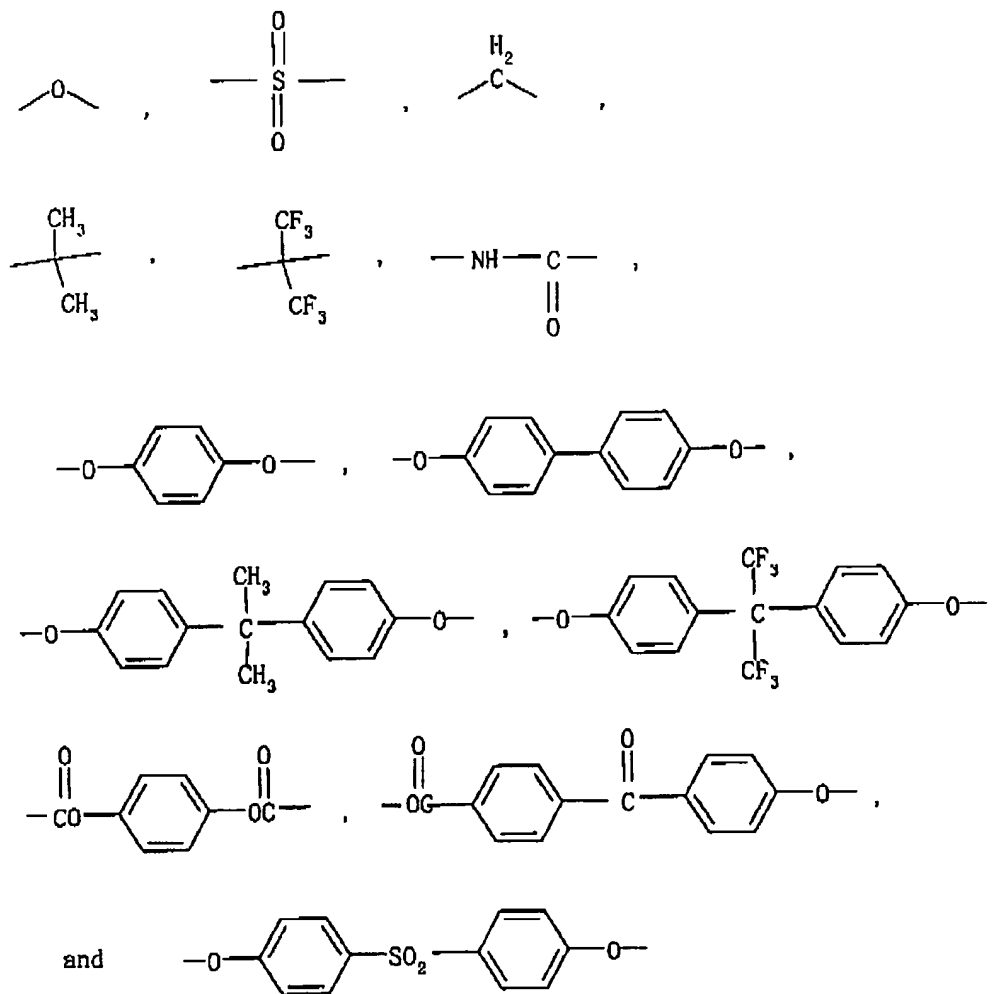Customer No. 26021

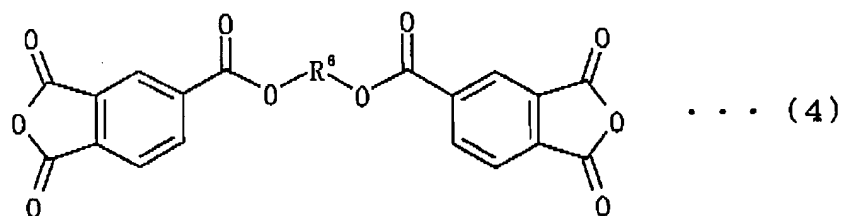and each R³ in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃, and the diaminodiphenyl ether being represented by General Formula (3):
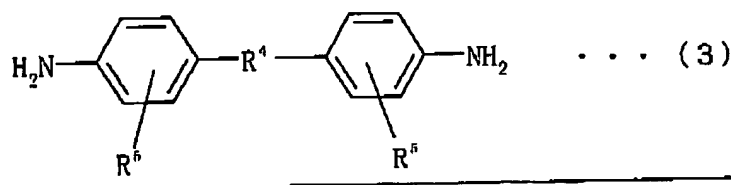
where R⁴ is a bivalent organic group selected from a group consisting of:

and each R^5 in the group is independently any one of -H, -CH$_3$, -OH, -CF$_3$, -SO$_4$, -COOH, -CO-NH$_2$, -Cl, -Br, -F, and -OCH$_3$,

wherein:

the acid dianhydride component further includes a bis(trimellitic monoester anhydride) and/or a biphenyl tetracarboxylic dianhydride,

Page 5 of 38

the bis(trimellitic monoester anhydride) being represented by General Formula (4):

$\cdots$ (4)

where R^6 is a bivalent organic group selected from a group consisting of:

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005
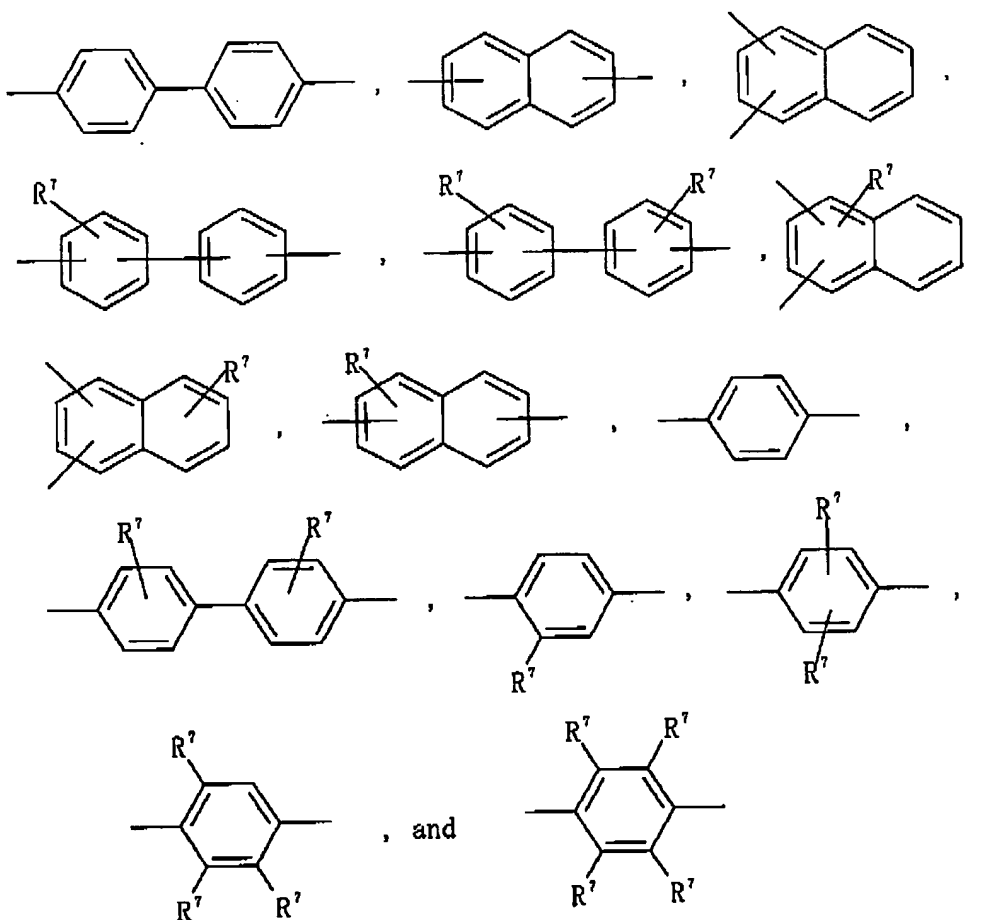
Attorney Docket No. 89227.0005
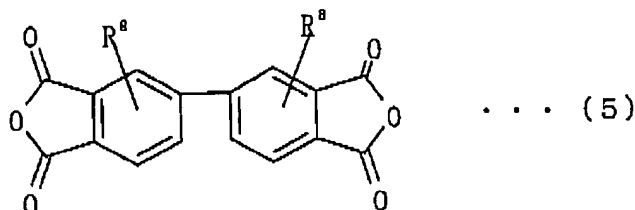Customer No. 26021

and each R^7 is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, and -CO-NH₂, and

the biphenyl tetracarboxylic dianhydride being represented by General Formula (5):

Page 7 of 38

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

$$\cdots (5)$$

where R^8 is a residue selected from a group consisting of H-, CH$_3$-, Cl-, Br-, F- and CH$_3$O-, and R^8 may be the same residues or the different residues.

6. (Previously presented) The laminate as set forth in Claim 5, wherein

the acid dianhydride component includes the bis(trimellitic monoester anhydride) in a range of from 20 mole% to 40 mole%.

7. (Previously presented) The laminate as set forth in Claim 5, wherein

the acid dianhydride component includes the biphenyl tetracarboxylic dianhydride in a range of from 0 mole% to 50 mole%.

8. (Currently amended) The laminate as set forth in Claim [[1]] 5, wherein:

the polyimide film has a coefficient of hygroscopic expansion is 16ppm/%RH or less, and a water absorption percentage is 2.0% or less.
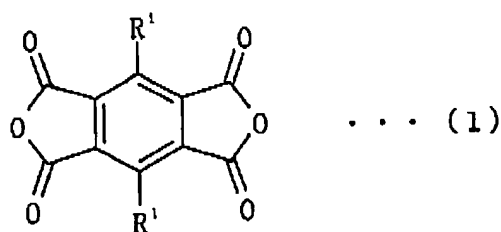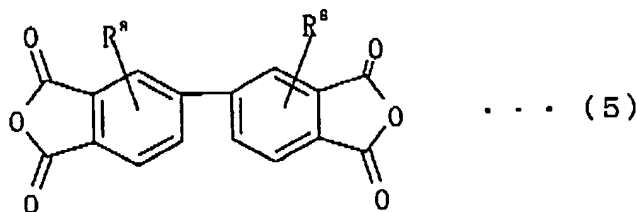
9-10. (Canceled)

11.   (Previously presented)   A polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component,

the acid dianhydride component including a pyromellitic dianhydride and a biphenyl tetracarboxylic dianhydride,

the pyromellitic dianhydride being represented by General Formula (1):

$\cdots$ (1)

where R^1 is a residue selected from a group consisting of H-, CH3-, CF3, Cl-, Br-, F-, and CH3O-, and R^1 may be the same residues or different residues, and the biphenyl tetracarboxylic dianhydride being represented by General Formula (5):

$\cdots$ (5)

where R^8 is a residue selected from a group consisting of H-, CH3-, Cl-, Br-, F- and CH3O-, and R^8 may be the same residues or the different residues, and

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
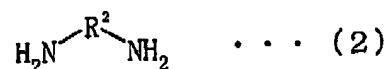Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

the polyimide film having such an etching speed that one side thereof is etched with a 1N potassium hydroxide solution at an etching speed of 0.1μm/minute (one side) or higher.

12. (Previously presented) The polyimide film as set forth in Claim 11, wherein:

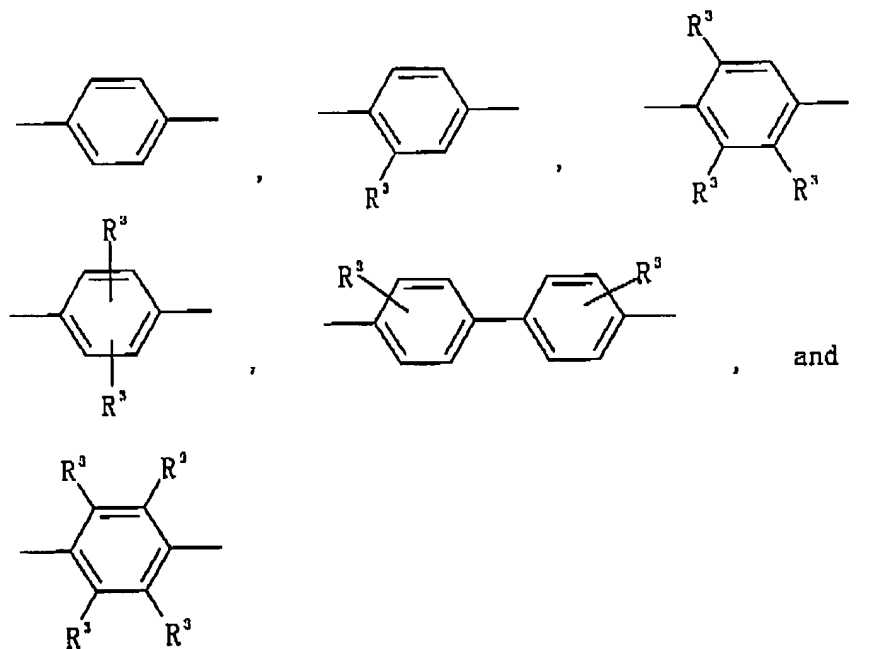the diamine component includes a paraphenylene diamine and/or a diaminodiphenyl ether,

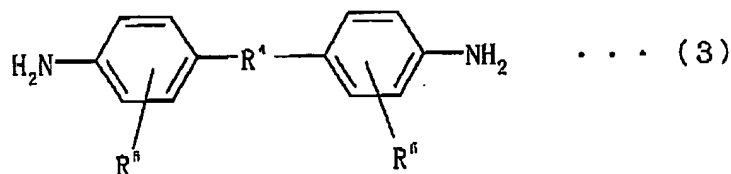the paraphenylene diamine being represented by General Formula (2):

$$H_2N{-}R^2{-}NH_2 \qquad \cdots \quad (2)$$

where R² is a bivalent aromatic group selected from a group consisting of:

and each R^3 in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃, and the diaminodiphenyl ether being represented by General Formula (3):

$$H_2N - \text{(ring)} - R^4 - \text{(ring)} - NH_2 \quad \cdots \quad (3)$$

where R^4 is a bivalent organic group selected from a group consisting of:

Appl. No. 10/667,134
Amdt. Dated February 21. 2006
Reply to Office Action of October 20, 2005
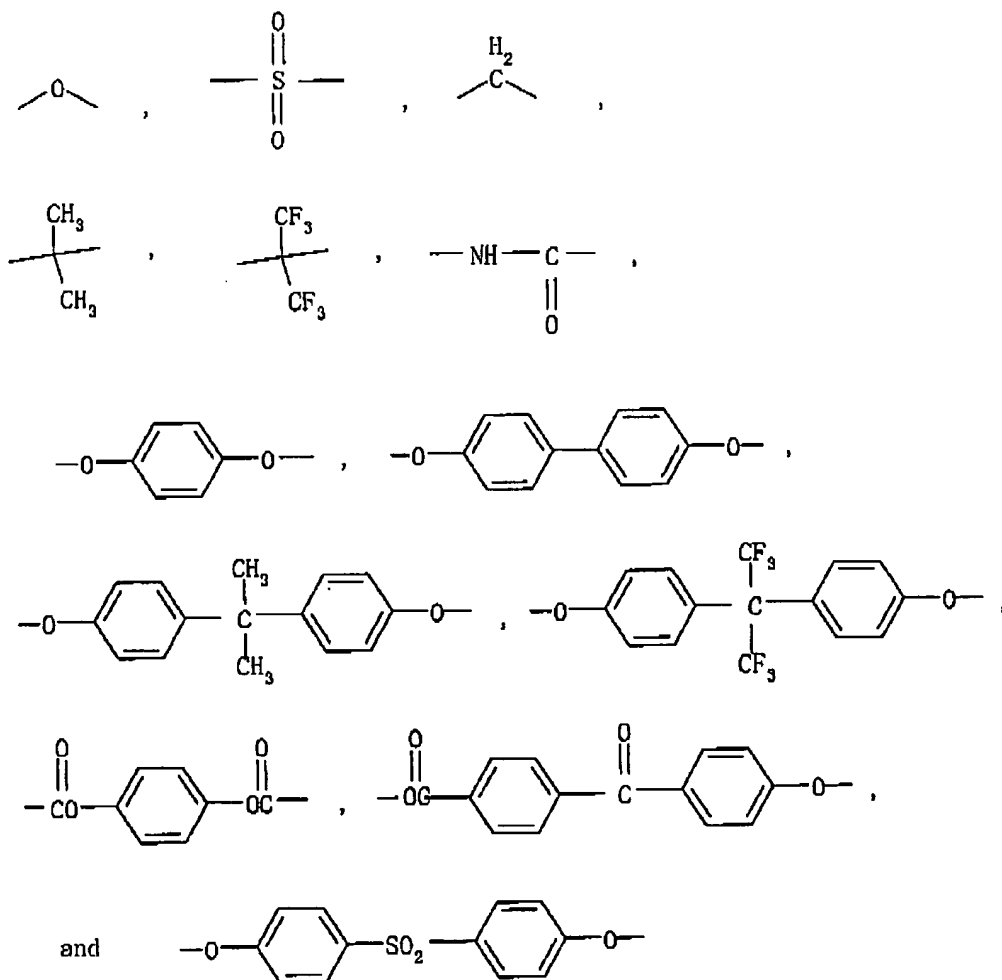
Attorney Docket No. 89227.0005
Customer No. 26021

and each R^5 in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃.

13. (Original) The polyimide film as set forth in Claim 11, wherein:

the acid dianhydride component includes the pyromellitic dianhydride in a range of from 30 mole% to 99.9 mole%, and the
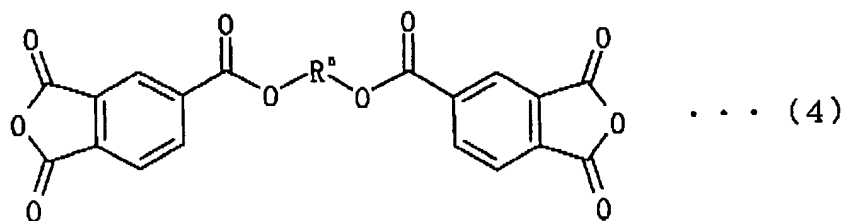
biphenyl tetracarboxylic dianhydride in a range of from 0.1 mole% to 50 mole%.

14.   (Original)   The polyimide film as set forth in Claim 12, wherein:

the diamine component includes the paraphenylene diamine in a range of from 15 mole% to 85 mole%, and diaminodiphenyl ether in a range of from 15 mole% to 85 mole%.

15.   (Previously presented)   The polyimide film as set forth in Claim 12,
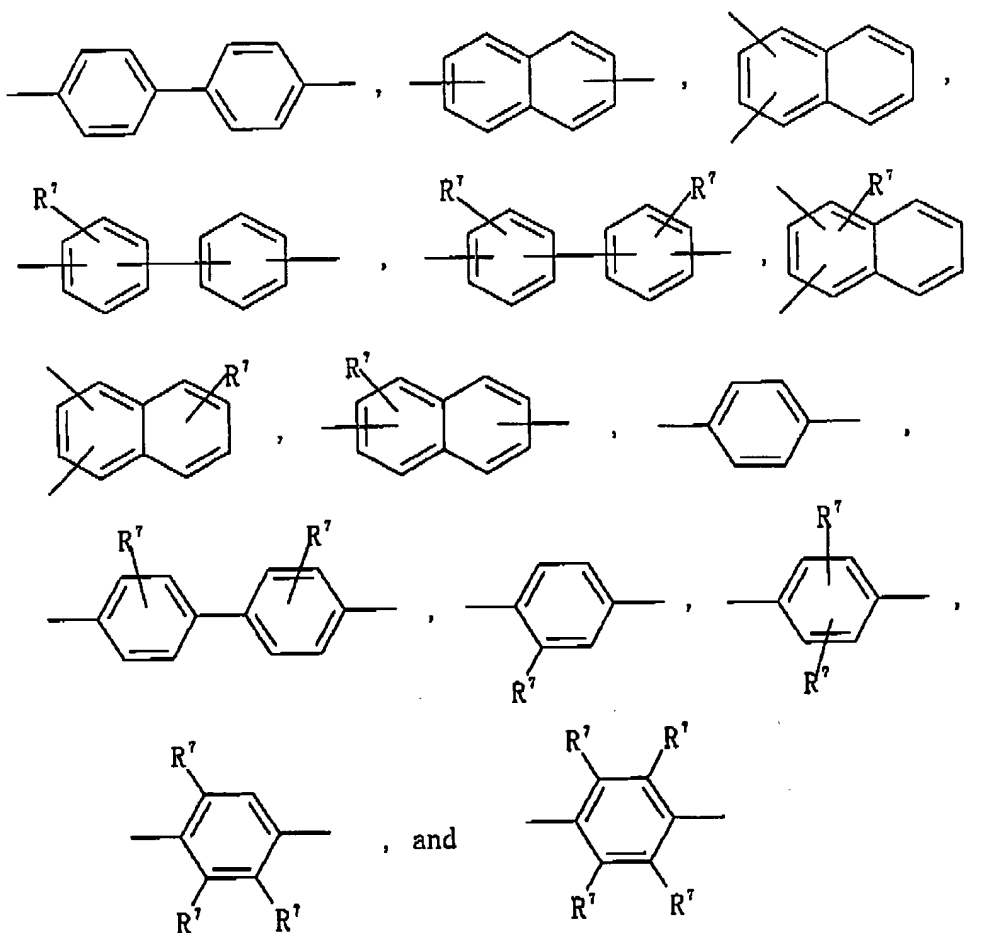
the acid dianhydride component further includes a bis(trimellitic monoester anhydride) being represented by General Formula (4):

$$\cdots \quad (4)$$

where R^6 is a bivalent organic group selected from a group consisting of:

and each R^7 is independently any one of -H, -CH$_3$, -OH, -CF$_3$, -SO$_4$, -COOH, and -CO-NH$_2$.

16.   (Original)   The polyimide film as set forth in Claim 15, wherein:

The acid dianhydride component includes the bis(trimellitic monoester anhydride) in a range of from 10 mole% to 50 mole%.

Page 14 of 38

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

17.   (Original)   The polyimide film as set forth in Claim 11, wherein:

a retention percent of tear-through resistance of the polyimide film after exposing the polyimide film to environment of a temperature of 150°C, a humidity of 100%RH, and 4 atmospheric pressure for 48 hours is not less than 50%.

18.   (Previously presented)   Laminate, comprising:

a metal layer; and

a polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component,

the acid dianhydride component including a pyromellitic dianhydride and a biphenyl tetracarboxylic dianhydride, the pyromellitic dianhydride being represented by General Formula (1):
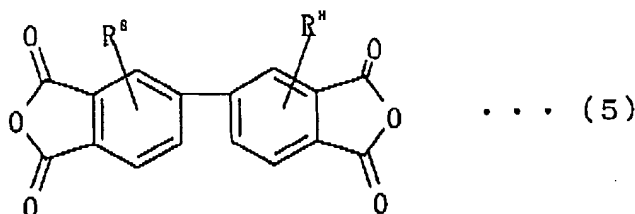

· · · (1)
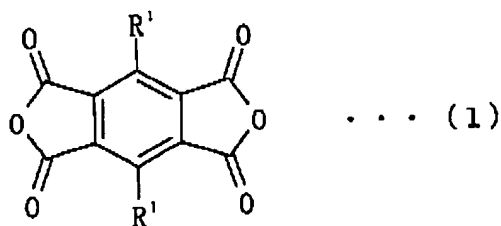
where R^1 is a residue selected from a group consisting of H-, CH_3-, CF_3, Cl-, Br-, F-, and CH_3O-, and R^1 may be the same residues or different residues, and

the biphenyl tetracarboxylic dianhydride being represented by General Formula (5):

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

··· (5)

where R^8 is a residue selected from a group consisting of H-, CH_3-, Cl-, Br-, F- and CH_3O-, and R^8 may be the same residues or the different residues, and

the polyimide film having such an etching speed that one side thereof is etched with a 1N potassium hydroxide solution at an etching speed of $0.1\mu m$/minute (one side) or higher.
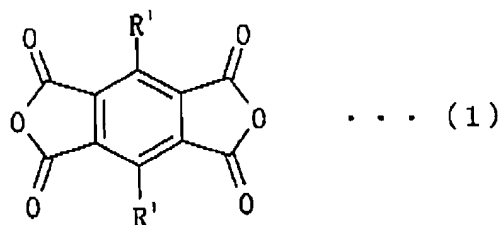
19.   (Previously presented)   A polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component,

the acid dianhydride component including the pyromellitic dianhydride, represented by General Formula (1), in a range of from 40 mole% to 80 mole%, the biphenyl tetracarboxylic dianhydride, represented by General Formula (5) in a range of from 1 mole% to 40 mole%, and the bis(trimellitic monoester anhydride, represented by General Formula (4), in a range of from 20 mole% to 50 mole%, and

the diamine component including the paraphenylene diamine, represented by General Formula (2), in a range of 25 mole% to 75 mole%, and the diaminediphenyl ether, represented by General Formula (3), in a range of 25 mole% to 75 mole%, where General Formula (1) is:
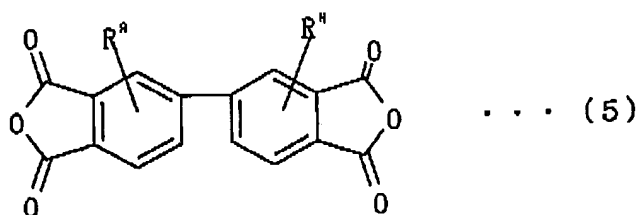
Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

$\cdots$ (1)

where R^1 is a residue selected from a group consisting of H-, CH$_3$-, CF$_3$, Cl-, Br-, F-, and CH$_3$O-, and R^1 may be the same residues or different residues;

General Formula (5) is:

$\cdots$ (5)

where R^8 is a residue selected from a group consisting of H-, CH$_3$-, Cl-, Br-, F- and CH$_3$O-, and R^8 may be the same residues or the different residues;
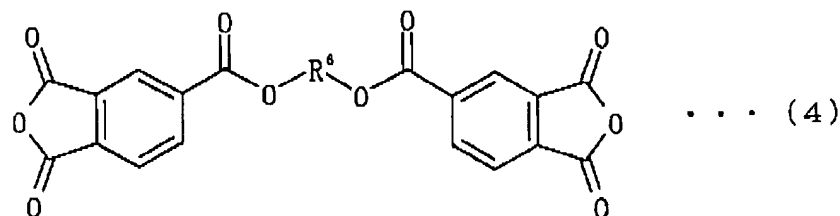
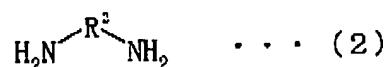General Formula (4) is:

Page 17 of 38

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

... (4)

where R⁶ is a bivalent organic group selected from a group consisting
of:

Page 18 of 38

and each R^7 is independently any one of -H, -CH$_3$, -OH, -CF$_3$, -SO$_4$, -COOH, and -CO-NH$_2$;

General Formula (2) is:

$$H_2N\text{---}R^2\text{---}NH_2 \quad \cdots \quad (2)$$

where R^2 is a bivalent aromatic group selected from a group consisting of:

and each R^3 in the group is independently any one of -H, -CH$_3$, -OH, -CF$_3$, -SO$_4$, -COOH, -CO-NH$_2$, -Cl, -Br, -F, and -OCH$_3$; and

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

General Formula (3) is:

$$H_2N-\ \ \ \ \ -R^4-\ \ \ \ \ -NH_2 \quad \cdots \quad (3)$$

where R^4 is a bivalent organic group selected from a group consisting of:

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
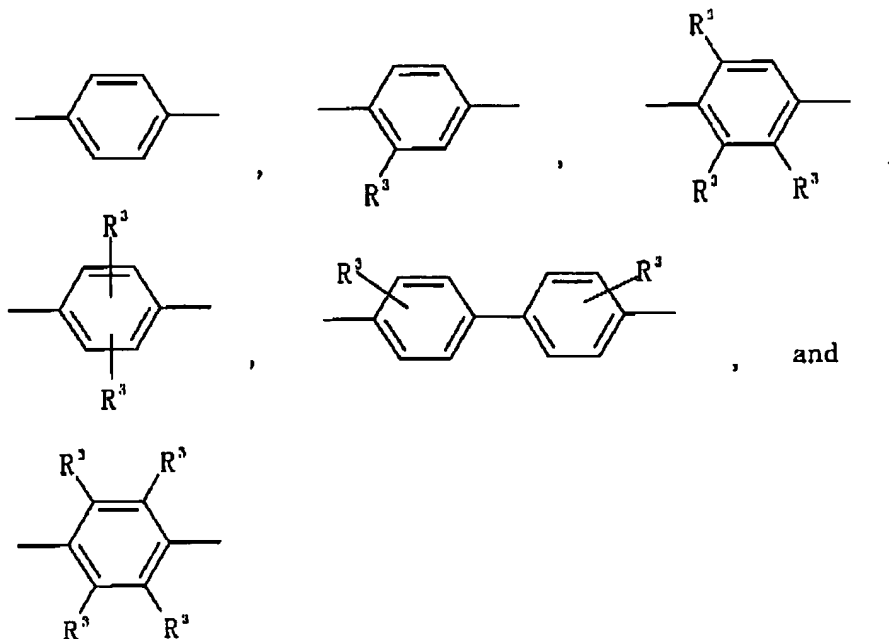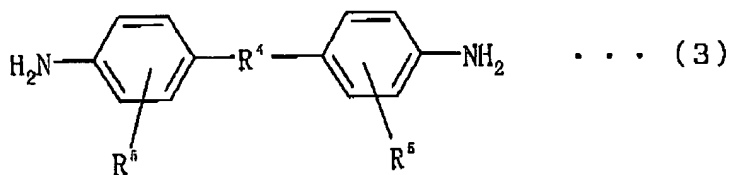Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021
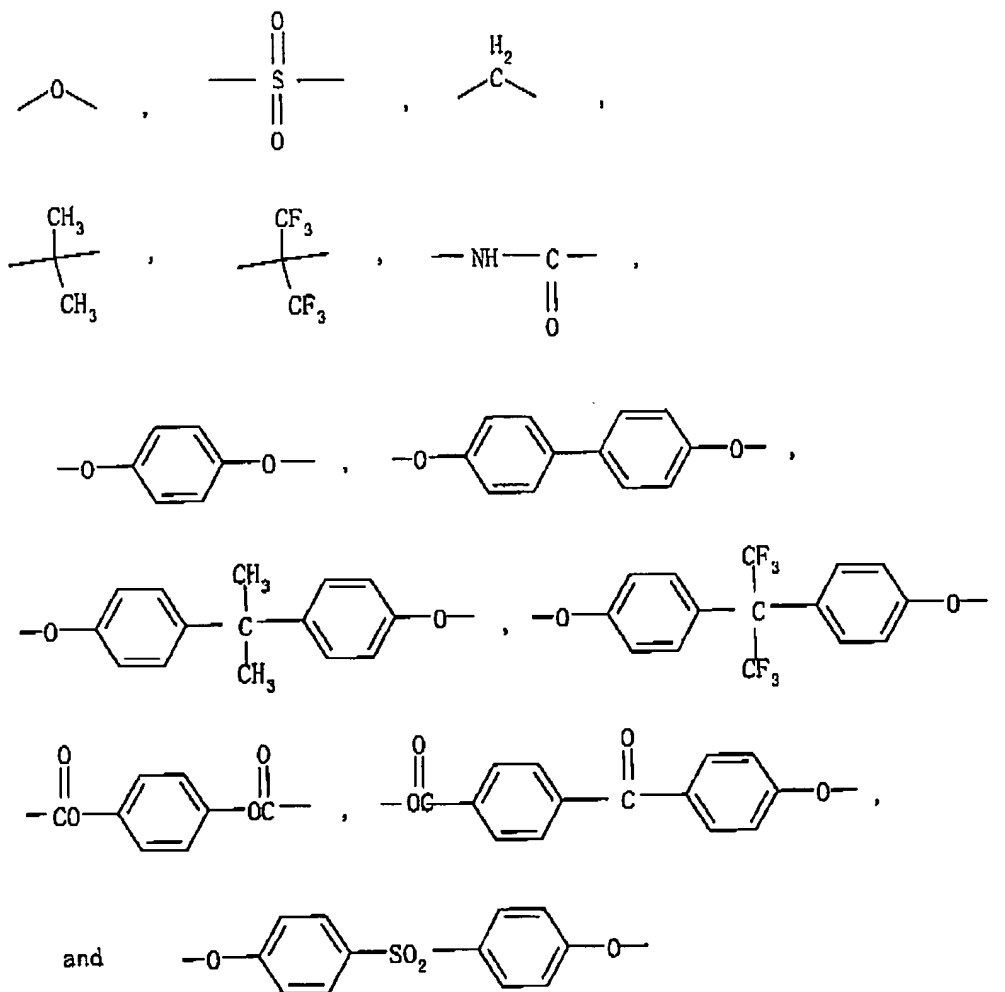
and each R^5 in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃.

20. (Original) The polyimide film as set forth in Claim 19, the polyimide film having a thickness in a range of from 1μm to 200μm.

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

21. (Original) The polyimide film as set forth in Claim 19, the polyimide film having a modulus of elasticity in a range of from 500kg/mm^2 to 800kg/mm^2.

22. (Original) The polyimide film as set forth in Claim 19, the polyimide film having a coefficient of hygroscopic expansion in a range of from 2ppm/%RH to 20ppm/%RH.

23. (Original) The polyimide film as set forth in Claim 19, the polyimide film having a coefficient of liner expansion in a range of 1 to 30 × 10^{-6}cm/cm/°C at a temperature of from 100°C to 200°C.

24. (Original) The polyimide film as set forth in Claim 19, wherein:
   a peel strength at an interface between the polyimide film and a metal layer of laminate is not less than 5N/cm, the laminate having the polyimide film and the metal layer that is formed on the polyimide film by vacuum depositing and electroplating; and
   a retention rate of the peel strength is not less than 10% after exposing the laminate to environment of a temperature of 121°C and a humidity of 100%RH for 12 hours.

25. (Previously presented) Laminate comprising:
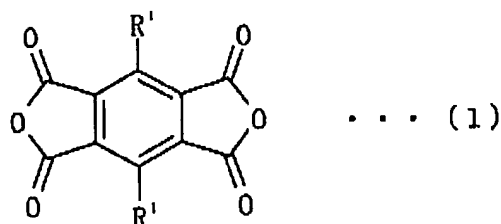   a metal layer; and
   a polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component,

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

the acid dianhydride component including the pyromellitic dianhydride, represented by General Formula (1), in a range of from 40 mole% to 80 mole%, the biphenyl tetracarboxylic dianhydride, represented by General Formula (5) in a range of from 1 mole% to 40 mole%, and the bis(trimellitic monoester anhydride), represented by General Formula (4), in a range of from 20 mole% to 50 mole%, and

the diamine component including the paraphenylene diamine, represented by General Formula (2), in a range of 25 mole% to 75 mole%, and the diaminediphenyl ether, represented by General Formula (3), in a range of 25 mole% to 75 mole%, where General Formula (1) is:
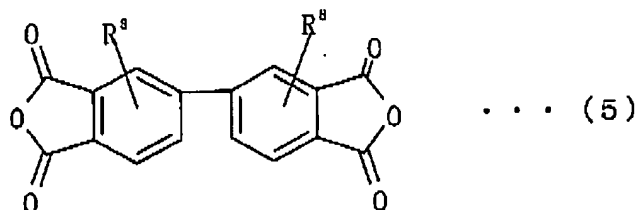

$$\cdots \quad (1)$$

where R^1 is a residue selected from a group consisting of H-, CH_3-, CF_3, Cl-, Br-, F-, and CH_3O-, and R^1 may be the same residues or different residues;

General Formula (5) is:

Page 23 of 38
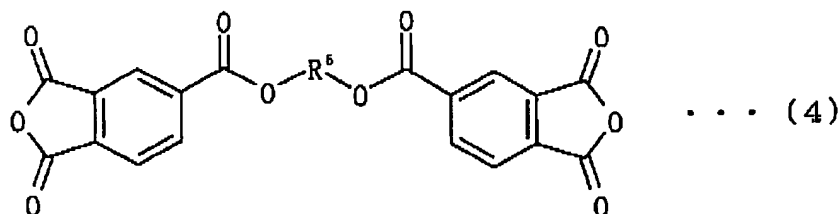
Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

$$\cdots (5)$$

where R^8 is a residue selected from a group consisting of H-, CH_3-, Cl-, Br-, F- and CH_3O-, and R^8 may be the same residues or the different residues;

General Formula (4) is:

$$\cdots (4)$$

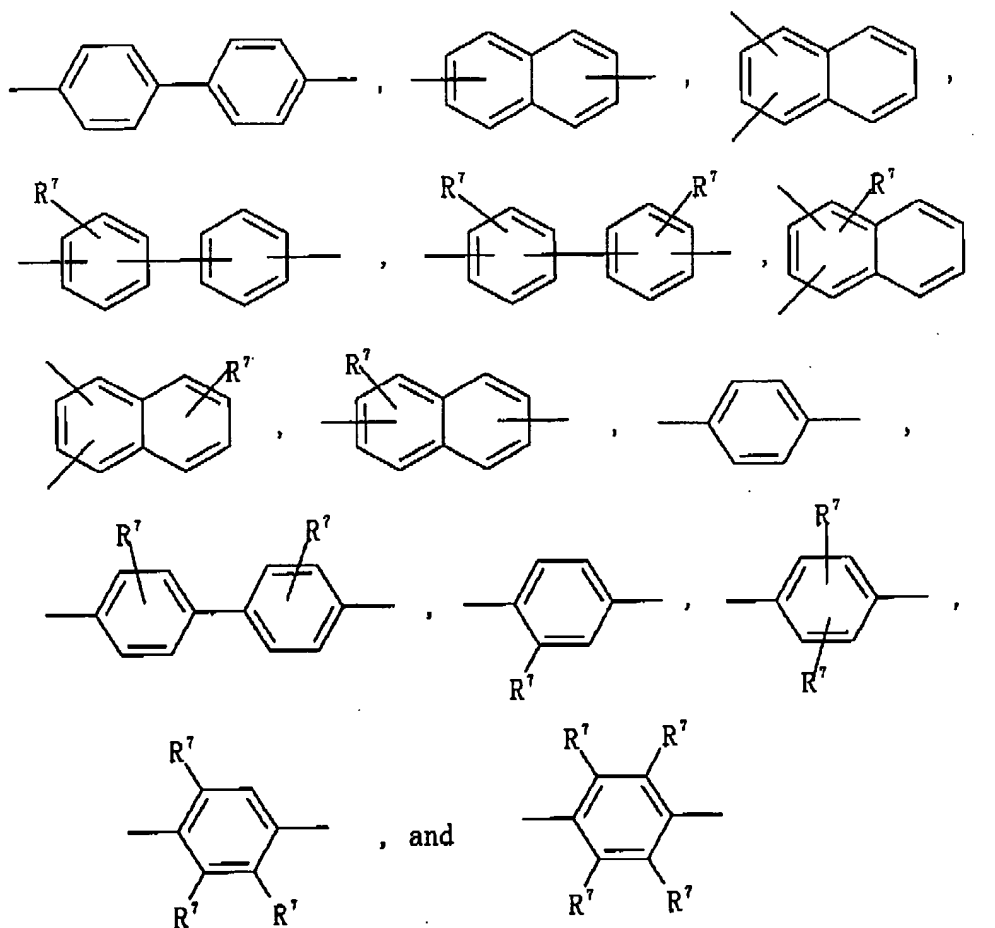where R^5 is a bivalent organic group selected from a group consisting of:

Appl. No. 10/667,134
Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005
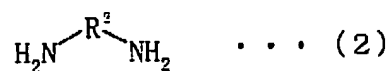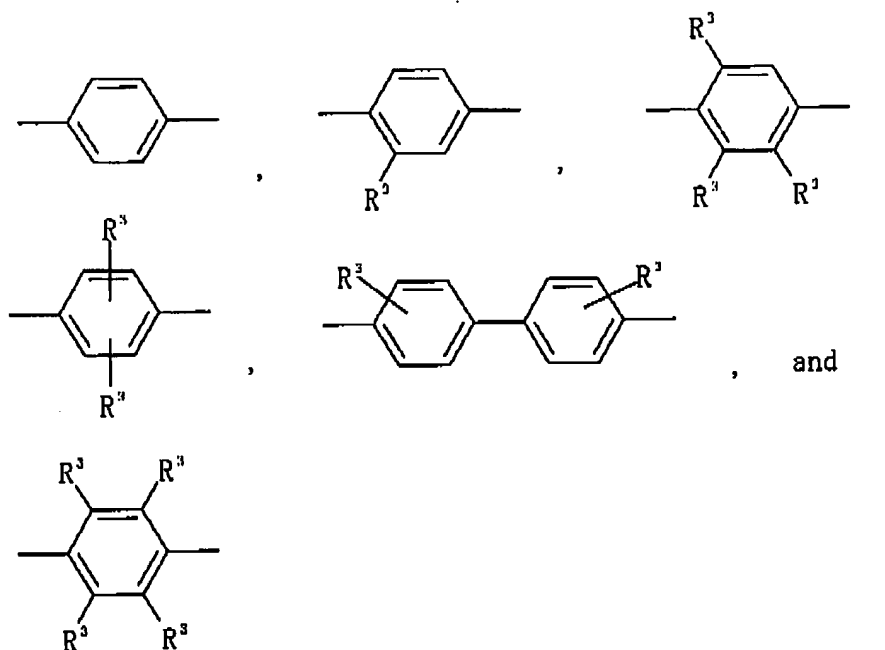
Attorney Docket No. 89227.0005
Customer No. 26021

and each R^7 is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, and -CO-NH₂;

General Formula (2) is:

$$H_2N \overset{R^2}{\diagdown} NH_2 \quad \cdots \quad (2)$$

Page 25 of 38

where R^2 is a bivalent aromatic group selected from a group consisting of:

and each R^3 in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃; and

General Formula (3) is:

$$\cdots (3)$$

Appl. No. 10/667,134
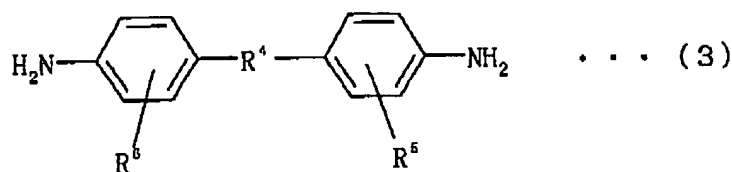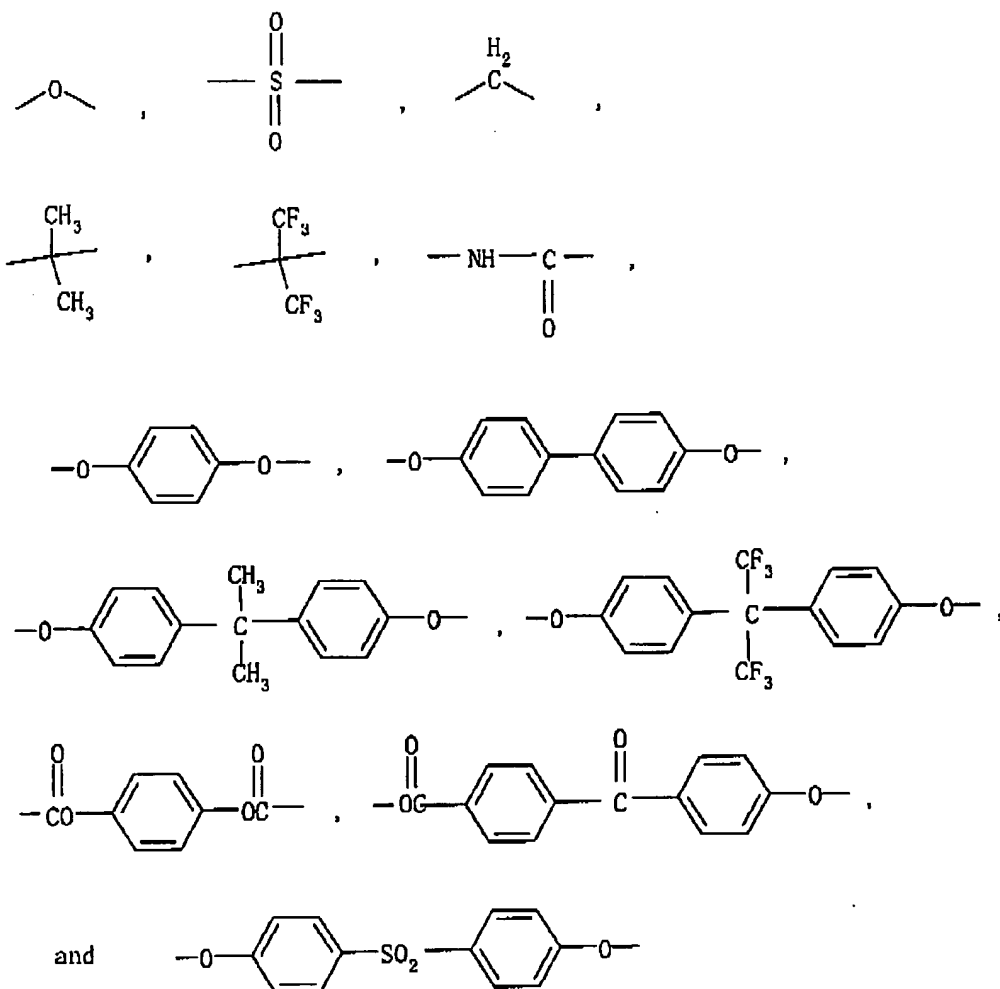Amdt. Dated February 21, 2006
Reply to Office Action of October 20, 2005

Attorney Docket No. 89227.0005
Customer No. 26021

where R^4 is a bivalent organic group selected from a group consisting of:

and each R^5 in the group is independently any one of -H, -CH₃, -OH, -CF₃, -SO₄, -COOH, -CO-NH₂, -Cl, -Br, -F, and -OCH₃.